



## Treatment of worm infested biological rapid sand filters

Christensen, Sarah Christine Boesgaard; Albrechtsen, Hans-Jørgen

*Publication date:*  
2014

*Document Version*  
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

*Citation (APA):*  
Christensen, S. C. B., & Albrechtsen, H-J. (2014). *Treatment of worm infested biological rapid sand filters*. Poster session presented at AWWA Water Quality Technology Conference & Exposition, New Orleans, LA, United States.

---

### General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.





# Treatment of worm infested biological rapid sand filters

**Sarah C.B. Christensen & Hans-Jørgen Albrechtsen**  
Contact: [scch@env.dtu.dk](mailto:scch@env.dtu.dk)



## Background

Water treatment in biological rapid sand filter is an extremely resource and energy efficient technology. The microbiological processes remove e.g. ammonia, manganese and iron in the raw water. It is therefore a prerequisite that the proper functional bacteria are present and under the right conditions. Danish drinking water production is based on simple treatment of groundwater consisting of aeration and filtration and no disinfectants are used in regular operation of the treatment plants.

However biological sand filters have proven also to host higher organisms such as round worms (nematodes) and segmented worms (oligochaete worms).

The largest worms found in Danish sand filters are 10 cm (approximately 4 inches) long. The large segmented worms are an aesthetical challenge to the water utilities whereas the microscopic roundworms have proven to host unwanted bacteria such as coliform bacteria.



Worm from the top layer of a rapid sand filter

## Ongoing studies

We expect oxidation with hydrogen peroxide to remove worms by impairing the function of the cuticula (skin) of the worms while being less damaging to the functional bacteria than chlorination.

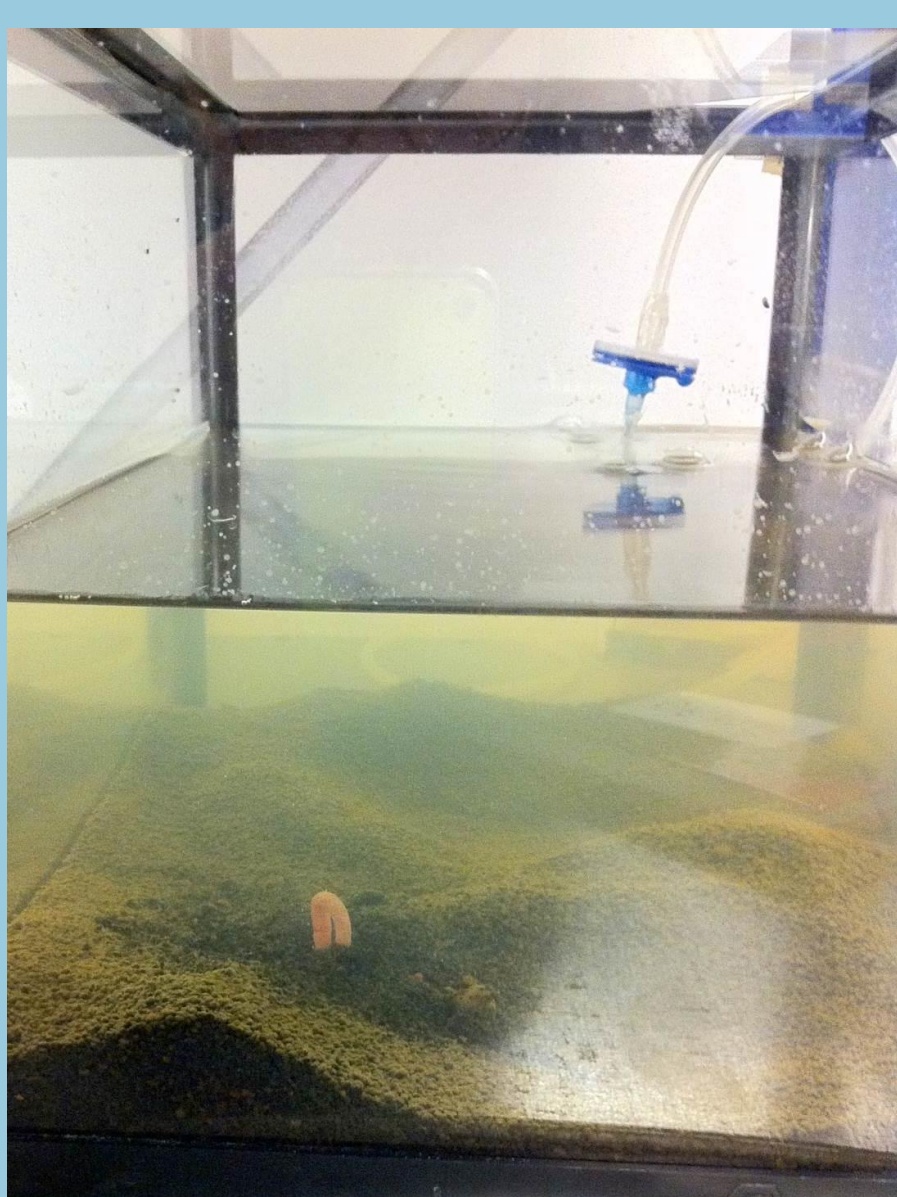
Batch experiments and pilot scale filter column experiments are being set up in order to test the removal efficiency while worms, protozoa and bacteria are quantified and filter functionality is monitored by measuring removal of ammonium and oxygen with an auto analyzer.



Sampling of segmented worms from the top layer of a drained biological rapid sand filter



## Challenges



Aquarium with a visible segment of a worm

In order to ensure a reliable supply of worms for the experiments we are continuously working on establishing a breeding population in our laboratory.

The worms are kept in filter sand with aerated raw water at 10° C in order to mimic conditions at the water works.

## Aims

- Develop a technology to remove the worms and their eggs from biological sand filters while minimizing the effects on the on the water treating abilities of the filter
- Investigate the impact of the worms on the biostability of the filters

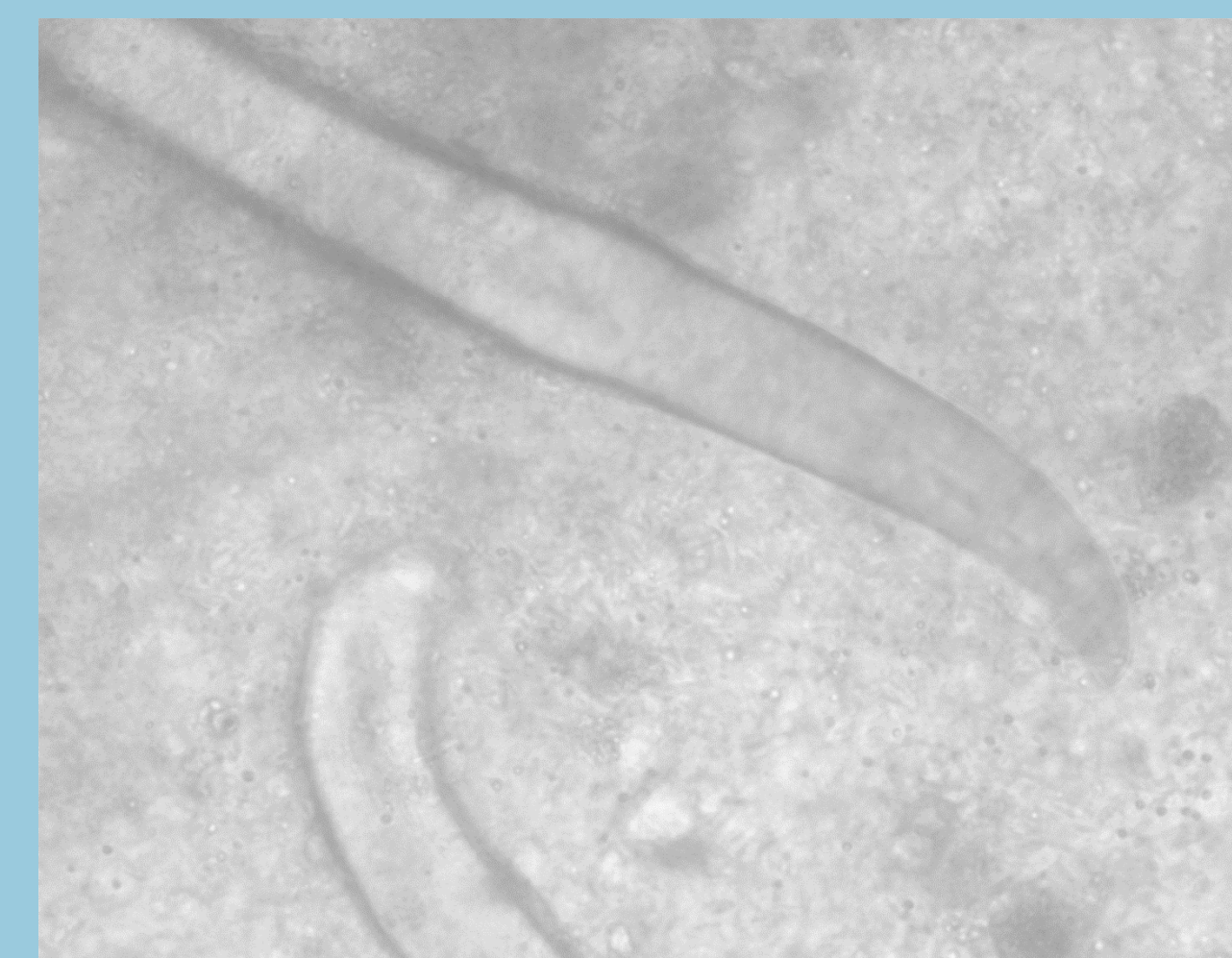


Intertwined worms sampled from top layer of a rapid sand filter

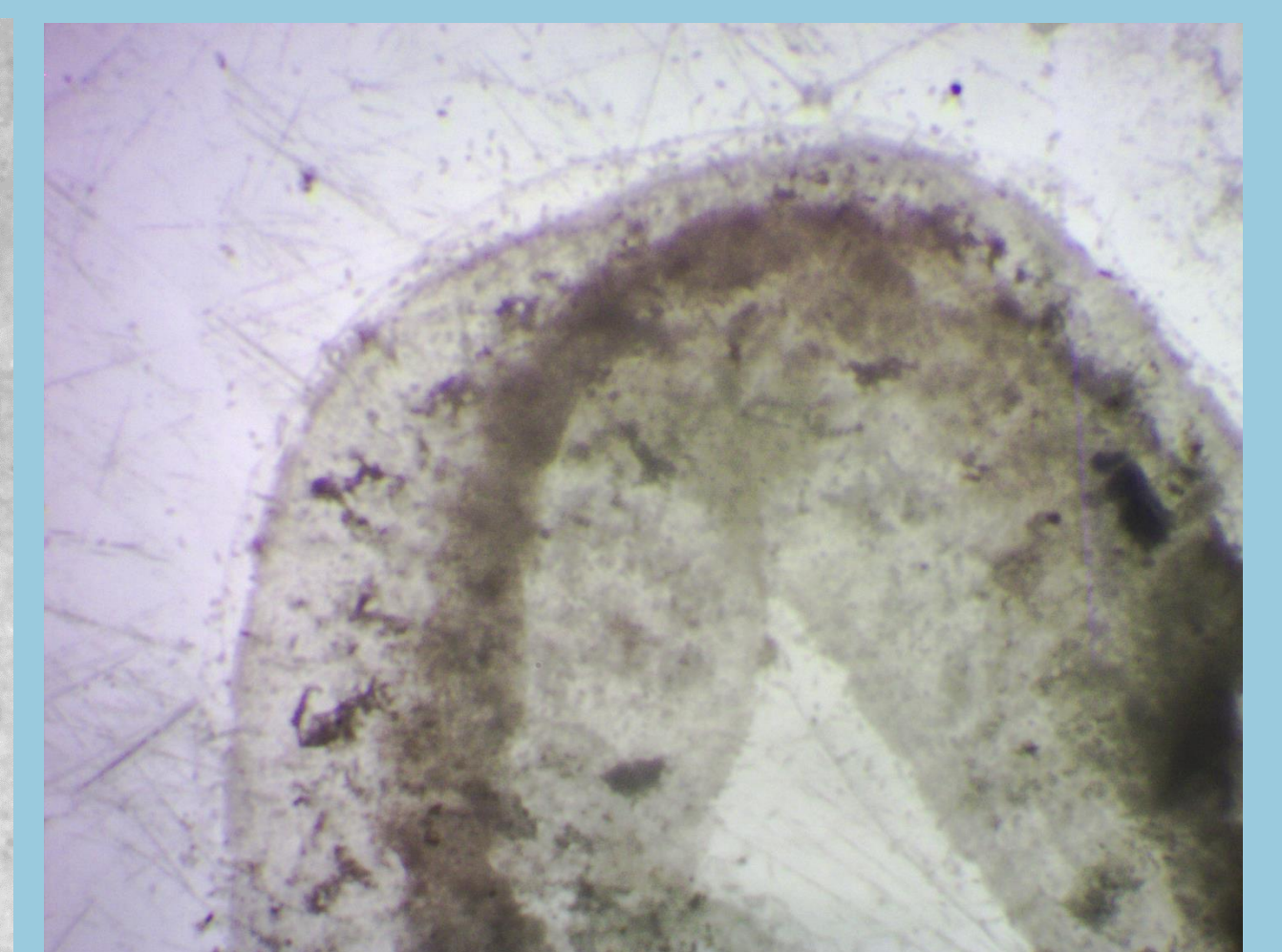
## Results

Experiences have been gathered from participating water works. High chlorine concentrations (20 liters NaClO, 15% active chlorine, in 5 m<sup>3</sup> water) and retention times of 24 hours had been applied at the investigated treatment plant, followed by back washing, since moderate dosing had previously proven insufficient.

The high chlorine concentration treatment efficiently removed worms and eggs from the full scale filters. However the treatment killed the functional filter bacteria and for more than three months the filters were not meeting the required level of removal of ammonia and nitrite. Bacterial counts (HPC) at both 22 and 37° C were above guideline levels for more than four months after the treatment.



Light micrographs of nematodes inside a dead worm



Dead worm being colonised by nematodes and protozoa

Microscopy of dead segmented worms was performed repeatedly over time to identify the organisms colonizing the worms.

The results revealed that degradation of segmented worms supports growth of nematodes (round worms) and protozoa (single celled eukaryotes).

These organisms digest bacteria and their proliferation may lead to impaired functionality of the filters caused by removal of functional filter bacteria.